

NASA's Earth Science Flight Program Meets the Challenges of Today and Tomorrow

NASA's Earth science flight program is a dynamic undertaking that consists of a large fleet of operating satellites, an array of satellite and instrument projects in various stages of development, a robust airborne science program, and a massive data archiving and distribution system. Each element of the flight program is complex and present unique challenges. NASA builds upon its successes and learns from its setbacks to manage this evolving portfolio to meet NASA's Earth science objectives.

NASA fleet of 16 operating missions provide a wide range of scientific measurements made from dedicated Earth science satellites and from instruments mounted to the International Space Station. For operational missions, the program must address issues such as an aging satellites operating well beyond their prime mission, constellation flying, and collision avoidance with other spacecraft and orbital debris.

Projects in development are divided into two broad categories: systematic missions and pathfinders. The Earth Systematic Missions (ESM) include a broad range of multi-disciplinary Earth-observing research satellite missions aimed at understanding the Earth system and its response to natural and human-induced forces and changes. Understanding these forces will help determine how to predict future changes, and how to mitigate or adapt to these changes. The Earth System Science Pathfinder (ESSP) program provides frequent, regular, competitively selected Earth science research opportunities that accommodate new and emerging scientific priorities and measurement capabilities. This results in a series of relatively low-cost, small-sized investigations and missions. Principal investigators whose scientific objectives support a variety of studies lead these missions, including studies of the atmosphere, oceans, land surface, polar ice regions, or solid Earth. This portfolio of missions and investigations provides opportunity for investment in innovative Earth science that enhances NASA's capability for better understanding the current state of the Earth system. ESM and ESSP projects often involve partnerships with other US agencies and/or international organizations. This adds to the complexity of mission development, but allows for a greater scientific return on NASA's investments.

The Earth Science Airborne Science Program provides manned and unmanned aircraft systems that further science and advance the use of satellite data. NASA uses these assets worldwide in campaigns to investigate extreme weather events, observe Earth system processes, obtain data for Earth science modeling activities, and calibrate instruments flying aboard Earth science spacecraft. The Airborne Science Program has six dedicated aircraft and access to many other platforms.

The Earth Science Multi-Mission Operations program acquires, preserves, and distributes observational data from operating spacecraft to support Earth Science

research focus areas. The Earth Observing System Data and Information System (EOSDIS), which has been in operations since 1994, primarily accomplishes this. EOSDIS acquires, processes, archives, and distributes Earth Science data and information products. The archiving of NASA Earth Science information happens at eight Distributed Active Archive Centers (DAACs) and four disciplinary data centers located across the United States. The DAACs specialize by topic area, and make their data available to researchers around the world. The DAACs currently house over 9 petabytes of data, growing at a rate of 6.4 terabytes per day.

NASA's current Earth Science portfolio is responsive to the National Research Council (NRC) 2007 Earth Science Decadal Survey and well as the 2010 NASA Response to President Obama's Climate Plan. As the program evolves into the future it will leverage the lessons learned from the current missions in operations and development, and plan for adjustments to future objectives in response to the anticipated 2017 NRC Decadal Survey.